National Institute of Environmental Health Sciences

Climate change impact of biochar cook stoves in western Kenyan farm households: System dynamics model analysis

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Abstract:

Cook stoves that produce biochar as well as heat for cooking could help mitigate indoor air pollution from cooking fires and could enhance local soils, while their potential reductions in carbon (C) emissions and increases in soil C sequestration could offer access to C market financing. We use system dynamics modeling to (i) investigate the climate change impact of prototype and refined biochar-producing pyrolytic cook stoves and improved combustion cook stoves in comparison to conventional cook stoves; (ii) assess the relative sensitivity of the stoves' climate change impacts to key parameters; and (iii) quantify the effects of different climate change impact accounting decisions. Simulated reductions in mean greenhouse gas (GHG) impact from a traditional, 3-stone cook stove baseline are 3.50 tCO(2)e/household/year for the improved combustion stove and 3.69-4.33 tCO(2)e/household/year for the pyrolytic stoves, of which biochar directly accounts for 26-42%. The magnitude of these reductions is about 2-5 times more sensitive to baseline wood fuel use and the fraction of nonrenewable biomass (fNRB) of off-farm wood that is used as fuel than to soil fertility improvement or stability of biochar. Improved cookstoves with higher wood demand are less sensitive to changes in baseline fuel use and rely on biochar for a greater proportion of their reductions.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Food/Water Security, Unspecified Exposure

Food/Water Security: Agricultural Productivity

Geographic Feature:

resource focuses on specific type of geography

Other Geographical Feature

Other Geographical Feature : Farmland

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Co-Benefit/Co-Harm (Family Planning/Population Reduction): ☑

specification of beneficial or harmful impacts to health resulting from efforts to promote family planning or reduce population growth as a climate change adaptation or mitigation measure

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Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Mitigation

Resource Type: ☑

format or standard characteristic of resource

Review

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

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